Experiments of Refining Gold *with* Antimony; *made by* Dr. Jonathan Goddard.

The Firſt with ſeveral parcels of freſh Antimony.

THere was taken of Crown-*Gold* (which is, as they call it, of 22 *keratts* fine, or $\frac{11}{12}$; and the Alloy is part *Silver*, part *Copper*, more of the *Copper* for the moſt part) to the quantity of 7 *peny weight* and 10 *grains*, *i. e.* 178 *grains*. This was melted down with two ounces and two drachms of *Antimony* (about ſix times as much as the Gold.) And becauſe the *Gold* was put in plates, for the more certain melting and mixture; the firſt *regulus* of *Gold* being ſeparated from the *Antimony*, both were powdered apart, and the *regulus* in the Melting-Pot laid upon the ſame *Antimony*, and ſo both melted down again. In both which meltings ſuch an heat was given, as made all of a clear light, even red heat, and boiling. Then the Pot was taken out of the fire, and all permitted to ſeparate, ſettle, and cool in it. Upon breaking the Pot the *regulus* of *Gold* (being very diſtinct in the bottom, and eaſily ſeparated from the *Antimony*) weighed 6 *peny weight* and 19 *grains* (163 *grains*.)

N.B. That this way of cooling all in the Pots was obſerved in all the following Experiments, for the more certain ſeparation and ſettlement of the *Regulus*, without effuſion into the *Antimony*-Horn (as they call it) or hollow Iron-Cone. Which effuſion, by confounding and cooling the mixture, may be ſome hinderance to a more perfect ſeparation. And to be ſure, in the bottom of the Cone there is always a thin cruſt of the crude *Antimony*, troubleſom to be ſeparated, without taking off ſome part of the *Regulus*.

Note alſo, That *Borax* was uſed in every Pot, for prevention of the ſticking of the *Regulus* to the bottom, and the *Antimony* to the ſides of it; ſo that both were gotten off clean and in full quantity.

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Of the *Regulus* a piece was broken off, which weighed 1 *peny weight* 14 *grains* and an half (38½ *grains*,) and was kept to be refined upon the Copel apart. The weight of the Remainder was therefore 5 *peny weight* 4 *grains* and an half(124½ *grains*.)

This Remainder being powder'd and put upon equal quantity of freſh *Antimony*, as at firſt, (*i.e.* two ounces and a quarter) and melted down, the *Regulus* weighed 3 *peny weight* and 2 *grains*, (74 *grains*).

The other Piece of 1 *peny weight* 14 *grains* and half, being refined on a Copel from the *Antimonial* ſubſtance mixed with it (by exhalation, promoted ſometime with a blaſt upon it, eſpecially toward the latter end, as in all the following Experiments of Refining upon the Copel) weighed 1 *peny weight* 6 *grains* and half (30½ *grains*:) and upon melting with *Borax* in a Crucible, loſt not above half a *grain*. So that the weight of the whole to the Gold it held, was as 38½ to 30½, or the Gold almoſt $\frac{5}{6}$ of the whole.

The latter *Regulus* weighing 3 *peny weight* and 2 *grains*, (*i.e.* 74 *grains*) being Refined in the ſame manner, weighed 2 *peny weight* and 15 *grains*, (*i. e.* 63 *grains*:) the *Gold* holding proportion to the whole, as 63 to 74, that is near upon $\frac{6}{7}$ of the whole. So that the ſame *Regulus* of *Gold* and *Antimony*, in paſſing through new *Antimony*, though it loſe much in weight, yet there is not a proportionable loſs of *Gold*: but is richer in *Gold*, as is proved by this and many other Trials; and ſo appears to ſenſe, being of a redder complexion, more tough and harder to powder.

Both the parcels of *Antimony* being ſaved for ſeparating the *Gold* remaining behind in them; they were ſeverally mixed with equal weight both of *Tartar* and *Nitre*, and then fired, and ſo reduced to a *Regulus*. Then the *Regulus* of each,exhaled and blown off upon Copels. Of the firſt parcel of *Antimony*, wherewith the *Gold* was firſt melted, the *Regulus* being exhaled, there remained in *Gold* 1 *peny weight* 12 *grains* (36 *grains*.) Which upon melting in a Crucible loſt ſomewhat, but ſcarce half a *grain*.

Of the ſecond parcel of *Antimony*, wherewith the firſt *Regulus* of *Gold* and *Antimony* (weighing 5 *peny weight* 4½ *grains*) was melted, there remained in *Gold* 1 *peny weight* 3 *grains*, (27 *grains*.)

All the other parcels were fine *Gold* to ſenſe, upon the Touch. Only that out of the firſt *Antimony*, was apparently unfine and pale, from the *Silver* in the original Alloy mixed with it, and not from any remainder of *Antimony*; as appeared by the inconſiderable waſte upon melting in a great heat with a blaſt upon it: And alſo by the Toughneſs and Malleability: and by comparing it, on the Touchſtone, with Sovereign-*Gold* allayed with *Silver*, to which it did agree, but was ſomewhat paler; holding, to the judgment of ſenſe, about a fourth part of *Silver*, as the Sovereign-*Gold* doth a ſixth. Neither was it altogether free from *Copper*; becauſe, upon Nealing, it always turned black on the ſurface.

But for more exact diſcovery, it was taken and firſt Refined with *Lead* upon a Copel, for ſeparation of any *Copper* that might be in it. Upon which operation, it came forth 1 *peny weight* 9½ *grains* (33½ *grains*;) which was 2½ *grains* leſs than it was before. Afterwards this laſt was melted with betwixt two and three parts of *Silver*, and ſo wrought in *Aqua fortis* for ſeparation of the *Silver*: and there remained in *Gold* 1 *peny weight*, 4½ *grains* (28½ *grains*) which was five *grains* ſhort of the former. And yet it appeared, upon the Touch, not fine, but paler than Fine-*Gold*, and deeper than Crown-*Gold* allayed with *Silver*. So that what remained in it was neceſſarily of *Silver*; and it might be eſtimated about 23 *keratts* fine; or to hold in fine *Gold* about 27 *grains*.

What loſs of *Gold* was upon this Refining with *Antimony*, may eaſily be computed. Firſt, one twelfth is to be deducted from the firſt quantity of Crown-*Gold*, being 7 *peny weight* and 10 *grains*, (178 *grains*) for Alloy; which is 14 *grains* and ⅙. So the remainder is, 6 *peny weight*, 19 *grains* and ⅚, or 163⅚ *grains*.

Then the ſeveral parcels of Fine-*Gold* recovered and ſeparated from the *Regulus* of *Antimony* and *Gold*, and alſo from the parcels of the crude *Antimony* reduced to *Regulus* are to be added together: that is to ſay, 1 *peny weight* 6 *grains*, 2 *peny weight* 15 *grains*, 1 *peny weight* 3 *grains*, and 1 *peny weight* 3 *grains* (the 27 *grains* laſt mentioned:) All which amount to 6 *peny weight* 3 *grains*. Which being deducted from the firſt quantity of 6 *peny weight* 19 *grains*, the difference is 16 *grains*, which is 1 tenth and 3 ſixteenths of one tenth.

For a more particular eſtimate, where and how this loſs of *Gold* ariſeth, it appeareth, that the parcel of *Antimony* wherein the *Gold* was firſt melted, is to be charged with $163\frac{5}{6}$ *grains* of fine *Gold*. Toward which, the firſt *Regulus* weighing 6 *peny weight* 19 *grains*, (163 *grains*) (in proportion to that piece of the ſame, weighing 1 *peny weight* 14 *grains* and half, and producing, upon refining on the Copel, 1 *peny weight* and 6 *grains* of pure *Gold*) muſt hold 128 *grains* of fine *Gold*. Then 1 *peny weight* and 3 *grains* (27 *grains*) of fine *Gold*, eſtimated to be contained in the 1 *peny weight* and 12 *grains*, ſeparated from this parcel of *Antimony*, and refined both by the Copel and Parting-water (as in the former account given hereof) being added to the 128 *grains*, makes 155 *grains*: which is ſhort of 163 *grains*, by 8 *grains*; and ſo much was irrecoverably loſt in this parcel of *Antimony*.

The piece of *Regulus* weighing 5 *peny weight* and 4 *grains*, (or 124 *grains*) melted with the ſecond parcel of *Antimony* (in proportion to the former piece broke off, weighing 38 *grains*, and upon refining yielding 30 *grains* of pure *Gold*) muſt contain 98 *grains* of the like *Gold*, and ſo much this ſecond parcel of *Antimony* muſt be charged with. Toward which, the *Regulus* weighing 3 *peny weight* and 2 *grains*, being refined, produced 2 *peny weight* and 15 *grains* (63 *grains*). And that *Gold* ſeparated from the ſame *Antimony*, being 1 *peny weight* and 3 *grains*, (27 *grains*) added to the former, make 90 *grains*: ſhort of the firſt quantity charged on this parcel of *Antimony* by 8 *grains*.

Some loſs of *Gold* may be upon powdering of the *Regulus* (rich in *Gold*) in an Iron-Morter, (for the more certain mixture with the *Antimony* than if it were put in in lumps) as alſo by the papers neceſſarily uſed. But it is moſt probable, that the greateſt loſs was by ſmall ſparks, which continually fly up while the *Antimony* is in a boyling heat with the *Gold*; which is always given it for the better ſatisfaction concerning the through melting and mixture. Theſe Sparks appear heavy, by their riſing not very high, and moſt of them falling down again upon the Metal and within the Pot: but many fly over into the fire.

Theſe Sparks appear to be *Gold* thus: When the Pot was covered with a plain ſmooth Earthen-cover, ſo that many of them, upon appulſe, did ſtick to it, and colour'd it of a deep-Red; *Aq. fortis* was firſt poured on, which did not diſſolve or fetch off any thing: after *Aq. Regia*, which did plainly work upon that ſubſtance, and ran off yellow, like a ſolution of *Gold* in the ſame Water.

It is not improbable alſo, that ſome loſs of *Gold* may be upon the firing of the *Antimony* (after the ſeparation of the *Golden Regulus*) for reducing it to a *Regulus* with *Tartar* and *Nitre*, which make a vehement conflagration with abundant ſparkling.

It hath been ſuſpected, that ſomewhat of the *Gold* may be diſſipated by the blaſt upon the Copels in refining it from the *Antimony* remaining in it. But this is not ſo probable; becauſe *Gold* hath been melted ſeveral times with a greater proportion of *Regulus* of *Antimony* Simple, than is contained in the *Golden Regulus*, and refined from it with the greateſt heat and blaſt that could be given, without any loſs. And it is the conſtant practice of ſome Refiners, who to give their Fine-*Gold* a higher colour for Gilding, to put to it one third or fourth part of crude *Antimony*, or of *Regulus* of *Antimony*, and with a great heat and ſtrong blaſt work it off; in which operation, in ſome Ounces of *Gold*, they loſe not one Grain.

The Second Experiment of repeating the Operation with the ſame Antimony.

There was taken of Crown-*Gold* to the weight of 5 *peny weight* $21\frac{1}{2}$ *grains*. Which was melted with one *ounce* and $\frac{1}{4}$ (about a ſixfold proportion) of *Antimony*. The *Regulus* weighed 5 *peny weight* and 3 *gr.*

From this, a piece weighing 1 *peny weight* and 6 *grains*, broken off and reſerved for refining by it ſelf; the remainder, being 3 *peny weight* and 21 *grains*, was melted down again with the ſame *Antimony*, being powdered and put on the top: and thereupon the *Regulus* came forth, weighing 3 *peny weight* and 19 *grains*: ſo that here was no conſiderable loſs. And there is ground to ſuſpect, that it might be upon ſome accidental difference in the managing, that the *Regulus* did not ſo perfectly ſeparate and ſettle: For in all other Experiments of melting the ſame *Regulus* again with the ſame *Antimony*, the *Regulus* gained weight; as in the next following.

From this ſecond *Regulus*, a piece broken off and reſerved for refining apart, weighing 1 *peny weight* and 12 *gr.* the remainder being 2 *peny weight* 7 *grains*, was melted down, as the former, and in the ſame *Antimony*. Whereupon the *Regulus* came forth in weight 3 *peny weight*; 17 *grains* being here gained to 55 *grains*, making the whole 72 *grains*, *i.e.* between $\frac{1}{4}$ and $\frac{1}{5}$.

The firſt piece of 1 *peny weight* and 6 *grains*, being refined upon the Copel, produced of Fine-*Gold* 1 *p. weight* juſt: which holds in proportion as 24 to 30. So that it contained four fifths of *Gold*, and but one fifth of *Antimonial* ſubſtance in it.

The ſecond piece weighing 1 *p. w.* and 12 *gr.* being refined upon the Copel, produced of fine *Gold* 1 *p.w.* and 4 *gr.* in proportion of 28 to 36, which is rather leſs than four fifths, as in the former; but the difference is inconſiderable for quantity.

The *Regulus*, upou the third melting, weighing 3 *peny weight*, refined upon the Copel, produced of fine *Gold* 2 *peny weight* and 7 *grains*. This holds in the proportion of four fifths: but ſomewhat ſhort of the next before.

Upon theſe compariſons, in this Experiment of repeating the melting of the *Regulus* with the ſame *Antimony*, the *Regulus* gaineth weight each time, but is in proportion leſs rich in *Gold*: both which are contrary, in repeating the melting of the *Regulus* with freſh *Antimony*, as in the former Experiments.

The remaining *Antimony* being reduced to a *Regulus* by firing with *Nitre* and *Tartar*, of each equal weight to it ſelf, and that *Regulus* exhaled upon the Copel, there remained of *Gold* 19 *grains*. This was leſs fine than that fetched out of the firſt *Antimony*, in the former Experiment of paſſing *Gold* through ſeveral parcels of *Antimony*; though loſing little ſenſible in weight, upon melting with a ſtrong heat and blaſt upon it. So that the impurity was not from any remaining *Antimonial* ſubſtance in it; but from the *Silver* and *Copper* mixed with it in the firſt Alloy. And theſe were eſteemed to be about a third part, by the judgment of the eye upon the Touch-ſtone. And ſo proved upon refining; firſt with *Lead* upon the Copel, for ſetching out the *Copper*; upon which it weighed 17 *grains* and half, *i.e.* one grain and half ſhort of what it was before: and then with *Aq. fortis*, after the melting down with more than the double weight of *Silver*; upon which Operation there remained 15 *grains*, and that not perfect fine, but retaining ſomewhat of *Silver*; but finer than Crown-*Gold* allay'd with *Silver*; upon the Touch, about twenty three *keratts*.

For computing the loſs of *Gold* upon this refining from the firſt quantity, *videlicet*, 5 *peny weight* 21 *grains* and half, a Twelfth part, (which is 12 *grains*, ſave about one ſixth of a grain) being deducted for Alloy, the remainder is 5 *peny weight* $9\frac{1}{2}$ *grains*, and $\frac{1}{6}$. And the ſeveral parcels of fine *Gold* produced of the *Regulus*, according to the account given in particular, added together; *vid.* 1 *peny weight*, 1 *peny weight* and 4 *grains*, 2 *peny weight* and 7 *grains*, and about 12 *grains* of fine *Gold* reckoned for the 19 *grains* of impure recovered out of the *Antimony*; all together make 4 *peny weight* and 23 *grains*: ſhort of the 5 *peny weight* and 9 *grains*, by about 10 *grains*; *i.e.* as 10 to 129, or very near one thirteenth.

The Third Experiment of exhaling the whole Antimony.

A parcel of Crown-*Gold*, weighing 3 *peny weight* 10 *gr.* and half, was melted down with an ounce of *Antimony* (about the proportion of ſix to one); and the *Antimony* was exhaled in the Crucible to a *Regulus.* Then the *Antimonial* part of that *Regulus* was exhaled on a Copel. Whereupon there remained 3 *peny weight* and 12 *grains*: which was more than the firſt *Gold* by 1½ *grain.* This muſt happen, for want of a heat ſtrong enough at laſt to force off all the *Antimonial* ſubſtance. Whence afterward, upon melting in a Crucible, it came ſhort 4 *grains*; *vid.* 3 *peny weight* 8 *grains*, which was but 2½ grains ſhort of the firſt quantity, and is the leaſt part of the proportion of *Copper* that muſt be in it, according to the uſual Alloy of Crown-*Gold*: which is generally two parts to one of *Silver*, or at leaſt the half.

So that *Antimony* in a far greater proportion, doth not ſo much, as *Lead*, in exhaling or ſeparating *Copper* from *Gold*; if the work be done meerly by Exhalation: but doth only retain it with it ſelf, whilſt the *Gold* ſeparates and ſettles in a *Regulus* at the bottom. Neither is it ſo deſtroyed, but that it may, in part at leaſt, be united to the *Gold* again.

That there remained *Copper* in this *Gold*, appeared farther by the black complexion of it upon Nealing. As alſo by the loſs upon working it with *Lead* on a Copel: whereupon it came forth 3 *peny weight* 4 *grains*, *i.e.* four grains ſhort.

A Relation of a Monſtrous Birth, made by Dr. S. Morris *of* Petworth *in* Suſſex, *from his own obſervation: and by him ſent to Dr.* Charles Goodall *of* London; *both of the Colledge of Phyſicians,* London.

AT *Petworth*, *Decemb.* 20. 1677. one *Joan Peto*, a Butchers Wife, after moſt acute pains was by her Midwife delivered of a monſtrous Female Birth.

It had two Heads Both the Faces very well ſhap'd. The left Face looked Swarthy: and never breathed. And the left Head was the bigger; and ſtayed longer in the Beating. The right Head was perceived to breath; but not heard to cry. Betwixt the Heads was a protuberance, like another Shoulder. The Breaſt (and Clavicles) very large; about ſeven Inches broad. But two Hands. And but two Feet. *Paræus* hath a Figure anſwerable to this Deſcription, excepting the Protuberance above-ſaid.

As to the Inwards: the Brain, in each Head, was very large. The *Spina Dorſi*, from the Neck to the Loyns, was double. There were alſo two Hearts, one on each ſide the *Thorax*. The left Heart the bigger. And two pair of Lungs; one infolding each Heart. Thoſe in the left ſide were blackiſh; the other looked well. The *Mediaſtinum* parted the two Hearts one from the other.

The *Aorta* and *Vena Cava*, below the Diaphragm, ſingle: the Diaphragm having only three perforations, as is uſual. But a little above it they were each divided into two Branches, diſtributed to the two Hearts in the figure of a